CLAIMS

1. An optical amplifier employing a rare earth-doped fiber as an amplification medium and including an input monitoring unit that monitors full input light and outputs an input monitor signal and an output monitoring unit that monitors full output light and outputs an output monitor signal, the optical amplifier comprising:

an ASE compensating circuit that compensates for a spontaneous emission (ASE) component contained in the full output light monitor signal;

a gain-variation-level compensating circuit that calculates a target average setup gain that is determined based on a signal intensity of the input monitor signal; and

a constant gain control circuit that performs a gain control based on an output signal from the ASE compensating circuit and the target average setup gain from the gain-variation-level compensating circuit.

2. The optical amplifier according to claim 1, wherein

a storage area is provided in either one of the constant gain control circuit and the gain-variation-level compensating circuit, and

an output gain profile used for the gain control of itself is stored in the storage area.

3. The optical amplifier according to claim 2, wherein

the output gain profile is generated based on the signal intensity of the input monitor signal for each signal intensity.

4. The optical amplifier according to claim 1, wherein

the ASE compensating circuit outputs an ASE

compensation signal obtained by subtracting the ASE component contained in the output monitor signal from the output monitor signal,

the gain-variation-level compensating circuit outputs a subtraction signal obtained by subtracting an offset component determined based on the signal intensity of the input monitor signal from the ASE compensation signal, and

the constant gain control circuit performs the gain control in such a manner that a ratio of the subtraction signal and the input monitor signal becomes identical to the target average setup gain determined based on the signal intensity of the input monitor signal.

5. An optical amplifier employing a rare earth-doped fiber as an amplification medium and including an input monitoring unit that monitors full input light and outputs an input monitor signal and an output monitoring unit that monitors full output light and outputs an output monitor signal, the optical amplifier comprising:

an input-level converting circuit that outputs a subtraction signal obtained by subtracting an ASE component contained in the output monitor signal and an offset component determined based on a signal intensity of the input monitor signal from the input monitor signal; and

a constant gain control circuit that performs a gain control in such a manner that a ratio of the output monitor signal and the subtraction signal becomes identical to a target average setup gain determined based on the signal intensity of the input monitor signal.

6. The optical amplifier according to claim 4, wherein the gain-variation-level compensating circuit includes

a compensation-level setting unit that generates

a gain compensation signal of a constant level; and

a subtracting unit that subtracts the gain compensation signal from the output monitor signal, and outputs a result of subtraction.

7. The optical amplifier according to claim 4, wherein the gain-variation-level compensating circuit includes

a compensation-level setting unit that generates a gain compensation signal of a constant level; and

a subtracting unit that subtracts the gain compensation signal from the input monitor signal and outputs a result of subtraction.

8. An optical amplifier employing a rare earth-doped fiber as an amplification medium and including an output monitoring unit that monitors full output light and outputs an output monitor signal, the optical amplifier comprising:

an optical-offset-signal output unit that outputs an optical offset signal;

an optical coupler that combines the full input light and the optical offset signal; and

an optical-level detecting unit that converts an output signal from the optical coupler into an electrical signal, wherein

a gain control is performed in such a manner that a ratio of an output signal of the optical-level detecting unit and the output monitor signal becomes identical to a target average setup gain determined based on the signal intensity of the input monitor signal.

9. The optical amplifier according to claim 1, further comprising:

a forward pumping-light source that injects pumping

light into the rare earth-doped fiber in a same direction as a direction of traveling of the full input light.

10. The optical amplifier according to claim 9, wherein the forward pumping-light source includes a semiconductor laser equipped with a wavelength stabilizing unit.

11. The optical amplifier according to claim 1, wherein a glass host material of the rare earth-doped fiber is any one of silicon oxide, tellurite oxide, and bismuth oxide.

12. A method of controlling a gain of an optical amplifier that employs a rare earth-doped fiber as an amplification medium, the method comprising:

a first calculating step of calculating a target average setup gain (G_M) at a maximum input intensity in an input dynamic range of a light input to itself;

a first gain setting step of setting the gain of itself to the target average setup gain (G_M);

a second calculating step of calculating a target average setup gain (G_m) at a minimum input intensity in the input dynamic range of the light input to itself;

a second gain setting step of setting the gain of itself to the target average setup gain (G_M) under a condition of the maximum input intensity and setting the gain of itself to the target average setup gain (G_m) under a condition of the minimum input intensity; and

a second calculating step of calculating a target average setup gain [$G(P_{in})$] at each input intensity in the input dynamic rage of the light input to itself.